

Levels of Protein and Protein Supplements to Milo Rations for Swine

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The importance of adequate amounts of high quality protein in the ration of growing pigs has been pointed out many times. The quality and quantity of protein in the swine ration probably has a greater influence on rate and economy of gain than any other single item. It has also been shown that the pig's need for protein changes as he grows and matures, with a higher percentage of protein as well as high quality protein being required by the younger pigs than by the more mature animals.

Previous tests at this station have indicated that high quality soybean meal was the most economical source of supplemental protein commonly available to swine feeders. Studies this year deal with the levels of protein needed by pigs during the various stages of growth, from weaning to market. Milo-soybean meal type rations containing 16, 14, and 12 percent crude protein were used. Ration changes were made when the pigs in a lot averaged 100 pounds and (or) 150 pounds.

The levels of protein fed at the various weight intervals are shown in Table 1.

Table 1.—Percentage of crude protein in the ration fed pigs of various weights.

Lot No.	1	2	3	4	5	6
Weight Periods:						
Up to 100 pounds	16	16	16	14	14	14
100-150 pounds	16	16	14	14	14	12
150-190 pounds	16	14	12	14	12	12

Nine to ten week old pigs weighing about 55 pounds were divided into groups of eight pigs each and self-fed their respective rations throughout the test. Hampshire, Poland China, and Yorkshire pigs were used. Two groups of 8 pigs each were fed on each ration in the summer trial (May to September) and a similar number in a winter trial (November to March). Water was available in automatic watering cups. Each pig was removed from the trial when it reached a weight of approximately 180 pounds in the summer trial and 190 pounds in the winter trial. Pigs fed during the summer were cooled by a water spray during the hottest part of the day (approximately 9:00 a.m. to 6:00 p.m.). Each pen was equipped with a nozzle which delivered about two gallons per hour in the form of a fine mist. The nozzles were placed about three feet above the floor.

The rations fed are shown in Table 2.

Table 2.—Rations Fed.

Percent Crude Protein Ingredients ¹	16	14	12
Kafir 44:14%	76.3	82.4	88.5
Soybean Meal	15.8	9.7	3.6
D. Alf. L. Meal	5.0	5.0	5.0
Bone Meal	2.0	2.0	2.0
T. M. Salt	0.5	0.5	0.5
Aurofac ²	0.3	0.3	0.3
Fortafeed ³	0.1	0.1	0.1
Total	100.0	100.0	100.0
Crude Protein %	16.01	13.99	12.02
Ration Cost per cwt. (\$)	2.82	2.76	2.70

¹ Zinc sulfate was added to all rations at the rate of 0.02% or 0.4 pounds per ton for prevention of parakeratosis.

² Aurofac—an antibiotic and B₁₂ supplement which contains 1.8 grams of aureomycin and 1.8 milligrams of B₁₂ per pound.

³ Fortafeed, a B vitamin supplement which contains 2,000 mg. riboflavin, 4,000 mg. pantothenic acid, 9,000 mg. niacin and 90,000 mg. choline chloride per pound of Fortafeed.

Ration changes were made when the average weight of the pig in a lot averaged 100 or 150 pounds.

The milo was ground moderately fine in a burr mill and mixed with the other components of the ration. All rations were self-fed.

Table 3 gives a summary of the results obtained on the four feeding trials. It can be observed that there is a gradual reduction in rate of gain as one moves from the higher to the lower protein levels. Pigs receiving a 16 percent protein ration throughout the trial gained 0.21

Table 3.—Summary of results of four trials on optimum levels of protein required by growing pigs.

Lot No.	1	2	3	4	5	6
Pigs per lot	31	31	31	32	30	32
Av. In. Wt. (lbs.)	56.7	57.5	56.6	57.0	57.0	56.6
Av. Final Wt. (lbs.)	192.7	192.0	189.3	185.3	187.8	187.6
Av. Daily Gain (lbs.)	1.58	1.57	1.54	1.42	1.46	1.37
Feed/Lb. Gain (lbs.)	3.55	3.61	3.66	3.87	4.06	4.26
Feed cost/lb. gain (cents)	10.30	10.30	10.30	10.89	11.33	11.80

pounds more per day than those receiving a 14, 12, 12 percent protein ration for the three periods. The relative average daily gain varied some from trial to trial but there was only one case in which pigs fed any combination starting on a 14 percent protein ration outgained those starting on a 16 percent protein ration. It, therefore, appears that pigs, weighing around 55 pounds need at least 16 percent protein in their ration to start with, possibly more, on this type of ration. Reducing the protein to 14 percent as the pigs reached 150 pounds had little effect on the rate of gain, nor did a change to a 14 percent ration at 100 pounds. Only slightly more feed was required when the protein level was reduced as the pigs became older (lot 3) than was required when a 16 percent protein ration was fed throughout the trial (lot 1). All three lots started on 16 percent protein (1,2,3) had a feed cost of 10.30 cents per pound of gain.

There was a distinct observable difference between the pigs started on a 16 percent protein ration and those started on the 14 percent protein ration. More bloom was evident on the pigs on 16 percent protein at the start of the trial but the pigs started on the 14 percent level were not particularly unthrifty in appearance.

Among the lots started on 14 percent protein, those in which the protein was reduced as the pigs became older (lots 5 and 6) produced the slowest and most expensive gain. Pigs in lot 6 (14,12,12) gained at the rate of 1.37 pounds per day with 4.26 pounds of feed required per pound of gain while pigs in lot 1 (16% protein throughout) gained at the rate of 1.58 pounds per day with 3.55 pounds of feed required per pound of gain. This is a difference of about 13 percent in rate of gain and 16 percent in feed required per unit of gain. There was also a difference of 1.50 cents per pound of gain in feed cost for those two lots.

The 16 percent crude protein ration cost \$2.82 per hundred, the 14% ration, \$2.76 and the 12 percent ration, \$2.70. An unusual feed price situation prevailed in which the soybean meal cost only \$0.95 per hundred more than the milo, making the rations quite similar in cost. Usually the difference in price between milo and soybean meal would be greater than this.

Combinations of soybean meal and cottonseed meal were tested in mixed rations containing about 14 percent crude protein. The results are summarized in Table 4.

From these results it appears that a low gossypol cottonseed meal may be fed with satisfactory results in combination with soybean meal if two parts soybean meal are used to one part cottonseed meal. When equal parts of soybean meal and cottonseed meal were fed, the rate of gain was not reduced but the feed required per hundred pounds of gain was increased by 22 pounds. Feeding larger proportions of cottonseed meal produced entirely unsatisfactory results. Results published

Table 4.—Soybean meal and combinations of soybean meal and cottonseed meal as protein supplements to a milo ration for swine.

(All rations 14% protein throughout the trial)
Summer 1956

Rations ^{1 2}	Summer 1956				
	I All S.B.M.	II ¾ SBM- ¼ CSM	III ½ SBM- ½ CSM	IV ¼ SBM ¾ CSM	V All CSM
Kafir 4414	82.4	82.2	82.1	81.9	81.5
Soybean meal	9.7	6.6	5.0	3.4	-----
Cottonseed meal ³	-----	3.3	5.0	6.8	10.6
Alfalfa meal	5.0	5.0	5.0	5.0	5.0
Bone meal	2.0	2.0	2.0	2.0	2.0
Salt	0.5	0.5	0.5	0.5	0.5
Aurofac ⁴	0.3	0.3	0.3	0.3	0.3
Fortafeed ⁵	0.1	0.1	0.1	0.1	0.1
Total ration	100.0	100.0	100.0	100.0	100.0
Ration cost per cwt. \$	2.76	2.75	2.75	2.75	2.75
Pigs per lot	8	8	8	8	8
Av. initial wt. (lbs.)	78.8	78.8	78.4	78.4	78.4
Av. Final wt. (lbs.)	193.5	193.4	190.9	188.5	181.6
Av. daily gain (lbs.)	1.48	1.53	1.49	1.34	1.19
Av. feed required per cwt. gain (lbs.)	370.8	370.8	392.8	398.9	404.5
Feed cost/Lb. gain (cents)	10.23	10.20	10.80	10.97	11.12

¹ 0.02 percent zinc sulfate was added to all rations for the prevention of parakeratosis.

² The Kafir 4414, soybean meal, cottonseed meal and alfalfa meal contained 10.78, 43.75, 41.00, and 17.34 percent protein, respectively.

³ High quality, prepressed, solvent extracted, low gossypol meal with a high nitrogen solubility.

⁴ Supplies 10.8 grams of aureomycin and 10.8 mg. of vitamin B₁₂ per ton of ration.

⁵ Supplies 4.0 gms. of riboflavin, 8.0 gms. of pantothenic acid, 18.0 gms. of niacin and 80.0 gms. of choline chloride per ton of ration.

in the 1955-56 Feeder's Day Report emphasized the dangers from feeding as little as 7.8 percent of a high gossypol cottonseed meal.

On the basis of a cost of \$3.45 per hundred for soybean meal and \$3.30 per hundred for cottonseed meal, as used in this test, there is little economic advantage for feeding a mixture of three parts of soybean meal and one part cottonseed meal. With a greater spread in price between these two feeds, there would be an economic advantage of feeding the combination over the soybean meal alone.

Urea in Protein Supplements for Wintering Beef Cattle

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Because of the complex nature of the ruminant stomach, cattle and sheep are able to utilize, to varying degrees, the nitrogen from urea and other non-protein nitrogen compounds. This utilization is possible because of the microorganisms in parts of the ruminant stomach. The utilization of non-protein nitrogen is apparently affected, therefore, by